

# Monitoring Cucurbit Downy Mildew

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August 2024



MICHIGAN STATE UNIVERSITY Extension

Downy mildew (DM) is a costly disease problem for Michigan vegetable growers. *Pseudoperonospora cubensis* is the fungal-like organism that causes this disease. This pathogen infects cucurbit crops including cantaloupe, cucumber, gourd, honeydew, muskmelon, pumpkin, squash, watermelon, and zucchini. DM is well known for causing catastrophic losses in a brief period of time.

## Recognizing DM on CUCURBITS

- Yellowing on top surface of leaves bound by veins
- Velvety or fuzzy dark spore growth on the underside of leaves

DM primarily causes symptoms on the leaves; cotyledons of seedlings may also be affected. Yellow lesions may be visible on the top surface of infected tissue (Fig. 1,2). DM lesions are similar to angular leaf spot or can be mistaken for herbicide damage (Fig. 3). However, the telltale sign of DM is the gray to black fuzz on the underside of the leaf giving a somewhat “dirty” or “velvety” appearance (Fig. 1,4). This fuzz may be most evident in the morning – scout fields early in the day!

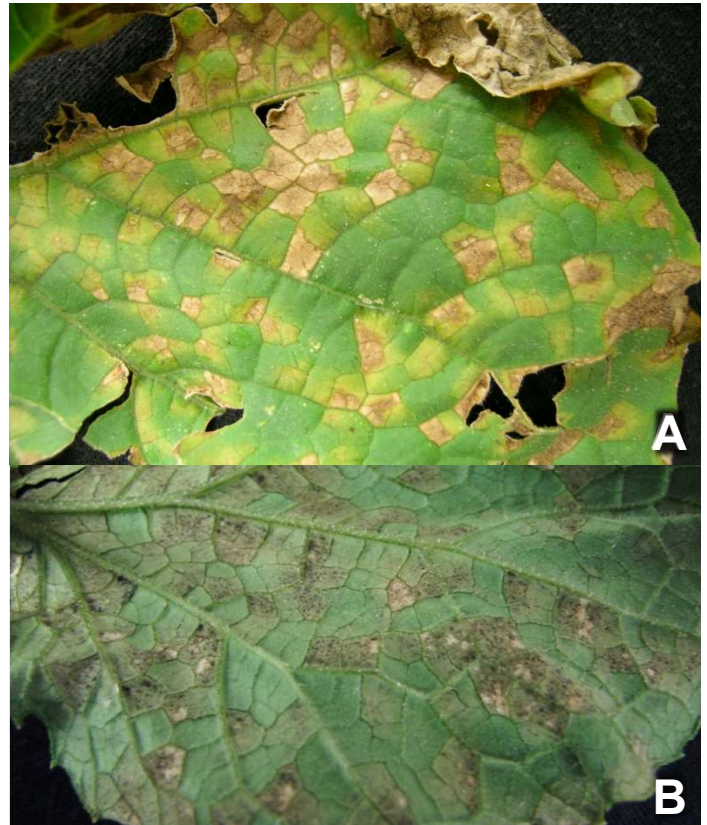


Figure 1. (A) Top side of cucumber leaf with yellow lesions and necrosis defined by the veins. (B) Underside of cucumber leaf displaying dark fuzzy spore masses.

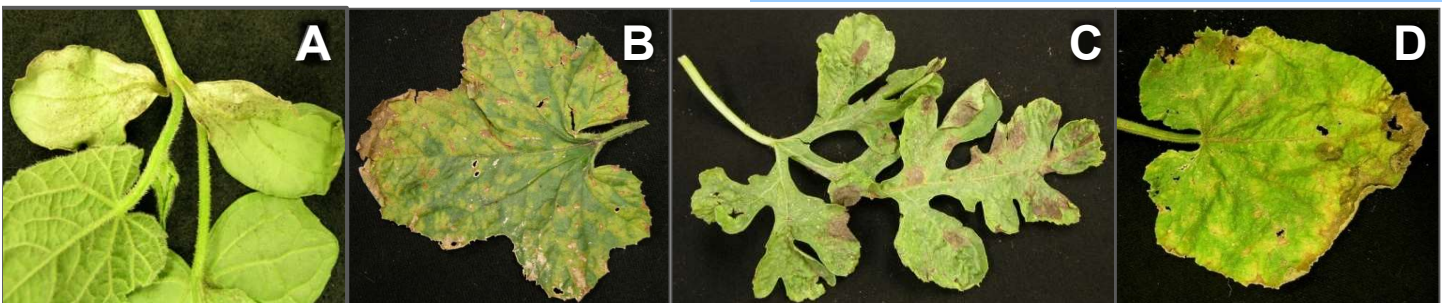


Figure 2. Symptoms of DM on (A) the cotyledons of a young cucumber seedling, and on leaves of (B) cantaloupe, (C) watermelon and (D) acorn squash. Lesions on these crops (B-D) are not as noticeably angular when compared to cucumber.

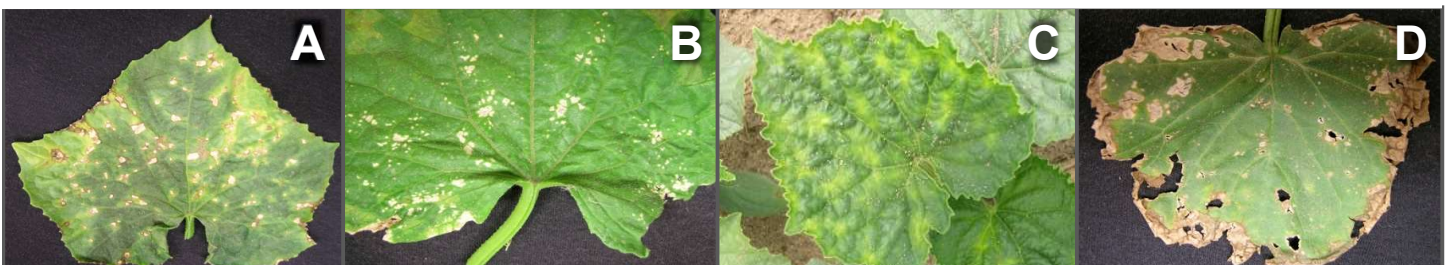
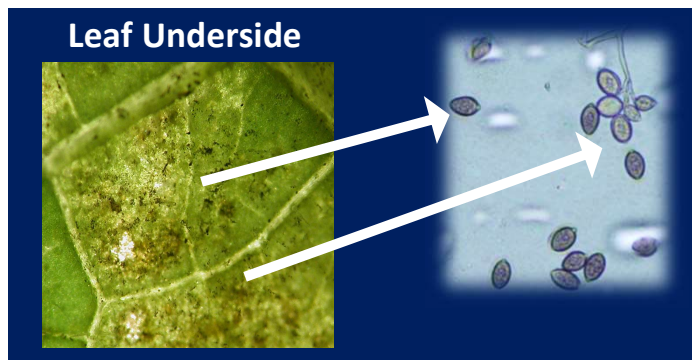


Figure 3. Common “look-alike” symptoms that are NOT DM. (A) Angular leaf spot, (B) heat stress, and (C,D) herbicide damage.



Changes in weather can quickly trigger DM outbreaks and crop loss. *Ps. cubensis* is an obligate biotroph, meaning it cannot live long without a host plant. This condition restricts the pathogen to warmer climates during the winter months, including southern states and greenhouses. DM spreads to surrounding fields on air currents via tiny, microscopic spores that act as seeds of the pathogen (Fig. 4). Cool (~60°F), wet, and cloudy conditions create an ideal environment for DM spores to survive outside the host. When the conditions are favorable, unprotected foliage can become completely blighted within 14 days of the initial infection. Symptoms of infection may initially present as water-soaked regions on the underside of the leaf (Fig. 5), directly below regions of upper-leaf discoloration.



**Figure 4. DM spores are carried on air currents enabling the pathogen to spread to neighboring fields and cause infection under favorable weather conditions.**

### Conditions for DM infection

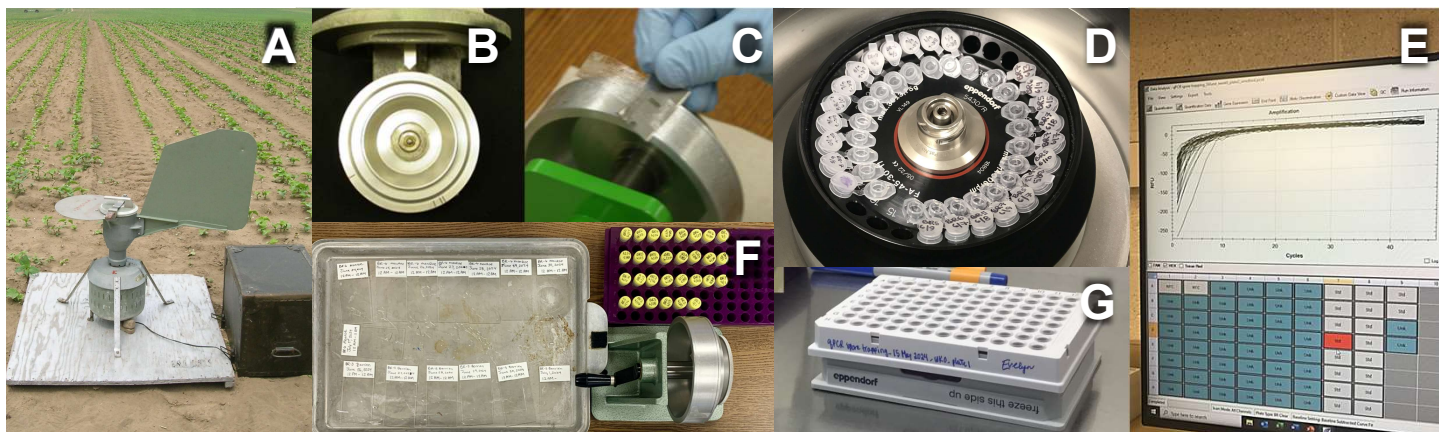
- DM spreads to surrounding fields on air currents
- Cool (~60°F), wet, and cloudy conditions create an ideal environment



**Figure 5. Early-stage symptoms of downy mildew may present as small, water-soaked lesions on the underside of the leaf.**

To achieve early detection of cucurbit downy mildew (DM), airborne spores from the pathogen are sampled using volumetric spore traps placed in major growing regions of Michigan during the spring and summer. These spore traps continuously collect spores by impacting them onto a film, which is then removed and analyzed in the laboratory. Quantitative PCR (qPCR) is employed to detect the presence of sporangial DNA and confirm positive cases of cucurbit downy mildew (Fig. 6). Additionally, a compound microscope is used to identify and count *Ps. cubensis* spores on the collected tapes in the early detection stage, to validate qPCR results. The spore traps are effective for detecting an influx of spores in the monitored production regions, but they are not used to time fungicide applications.

Go to [www.veggies.msu.edu](http://www.veggies.msu.edu) for more information and management recommendations. If you need help identifying cucurbit DM, click on the link “[How to submit samples](#),” for instructions on how to submit diseased plant samples to MSU Plant Diagnostics.



**Figure 6. Field spore traps (A) used for monitoring airborne DM spores. Spores are embedded onto a sticky film on a mechanical reel (B) and taken back to laboratory for (C-G) identification and quantification.**

This material is based upon work that is supported by MSU project GREEN, a Michigan Specialty Crop Block Grant awarded to the Michigan Vegetable Council, Pickle Packers International (Agricultural Research Fund and Pickle and Pepper Research Committee), and the National Institute of Food and Agriculture, U.S. Department of Agriculture, award number 2020-51181-32139.